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ABSTRACT

This paper reports an investigation of inferencing in Form Five of the Reading Comprehension component of the Iowa Tests of Basic Skills. The first step in the investigation consisted of an analysis of the language of the test to determine how the inferencing strategies employed might serve to mask answers. This preliminary analysis suggested that conflicting strategies available for answering a given question might make it difficult for students to determine the strategy for which the test would credit them. A second stage of the study focussed on a comparison between the observations made in step one and students' perceptions of ambiguities in the test. Six children each in grades three, five and seven representing a spread of reading ability and verbal skills were interviewed within a month following administration of the test. While their ability to talk about the ambiguities varied, they did detect them. This investigation led to the conclusion that while the test necessitates reading comprehension, it really measures the particular language skills possessed by test-wise children. (Author/AMH)

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INFERENCING IN A STANDARDIZED READING COMPREHENSION TEST

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

1.0 Standardized multiple choice reading comprehension tests have received much criticism in recent years, and with good reason. A major portion of this criticism has focused on biases inherent in aspects of their content and style against non-white, non-middle class children, against creative nonconventional children, in general against children who are not high achievers in a relatively typical school setting (Greene-Sullivan, 1972; Meier, 1972; Perrone, 1975). This paper approaches one of these tests, Form 5 of the reading comprehension component of the Iowa Tests of Basic Skills, from a slightly different perspective. It investigates the language of the test in an effort to understand how the inferencing strategies employed can lead children of virtually any background or ability to select distractors rather than answers. It appears that the demands of norm-referencing have created a situation in which, since a test passage is available for examinees to return to in answering any given item, various tactics must be used to hide or disguise the answer. The tactics are interesting and often quite ingenious, if viewed from an objective linguistic point of view. But when the children who must face the test are taken into consideration, many of the tactics begin to look like dirty tricks. Whatever one's viewpoint, it is clear that while the test necessitates reading comprehension, it really measures the particular language skills possessed by test-wise children.

In what follows, I would like to report on two approaches I have taken to investigating inferencing in the test. The first involves my own analysis of how inferences that lead children to select distractors are made available in the linguistic unit created by the test passage and the items pertaining to it. The second approach involves interviews with children. I knew that my investigation was a good first step, but meaningless in the absence of responses of real

children to the language of the test. While my sample was small, and only a small portion of the data has been analyzed, valuable information has been revealed about perceived ambiguity and what constitutes successful or not so successful attempts to resolve it.

2.0 The process of answering any given item on the test crucially and integrally involves inferencing, even when the answer is explicitly conveyed in the passage. That is, many language cues must be used to identify the relevant part of a passage and separate the answer from the three distractors. Most of the answers in the test are not explicitly conveyed. More often they are either conveyed implicitly, or they are dependent on background knowledge not conveyed in the passage at all. While successful reading necessarily involves bringing background information to bear, testing such knowledge in a multiple choice reading comprehension test does not seem reasonable, particularly when, in contrasting instances, something that is true in the real world and relevant to the passage is a distractor but not the answer. The two contrasting situations are illustrated in (1) and (2).[1]

(1) The blue whale, the largest living mammal, may soon be gone from the sea. These enormous creatures, that may grow to a length of 90 feet, are great prizes for whalers. Oil and other products from these and other species of whales are very important to a number of countries. Since World War II, the whalers have become so good at taking a catch that there may soon be no whales to catch. Experts say that there were 100,000 blue whales in Arctic and Antarctic waters 30 years ago. Now they put the number at about 1000.

120. Which of these might be partly responsible for the improvement in whaling techniques referred to in the fourth sentence?

a) The invention of the whaling harpoon
b) The development of radar
c) The formation of the International Whaling Commission
d) New laws that allow the use of large guns in whaling (I.T.B.S., p. 19)

(2) . . . After the War Between the States, frontiers were vanishing and new land was greatly desired. An area called the "Unassigned Lands" did not belong legally to either the Indians of the Oklahoma territory or to the many cattlemen who used the plains for grazing, and would-be settlers eyed the land with much interest.

83. Why were settlers so interested in the territory?

a) Frontier land was getting scarce.
b) It was the last home of buffalo.
c) The land was selling cheaply.
d) They wanted to rid the land of the Indians. (I.T.B.S., p. 16)

Item no. 120 sends readers back to ferret out the fourth sentence, only to find that to answer the question they must rely on real world information. In contrast, while the answer to item no. 83 can be inferred from the passage, unfortunately, too many children have learned that (d) is also true. That is, children familiar with the attitude toward American Indians that generally prevailed in the unfolding of United States history might well realize that based on real world knowledge, (d) is a perfectly reasonable inference, even though in this case using background information is not the appropriate strategy.

The preceding phenomenon represents one of two sets of situations demanding opposing inferencing strategies, an opposition that may make it difficult for children to predict which strategy they are being asked to employ in any given instance. A second set of opposing inferencing strategies involves instances where, on one hand, the answer is an inference available from the passage and yet one or more distractors is also a perfectly reasonable inference, and on the other hand, the answer is a masquerading or illegitimate inference actually discouraged, though not completely blocked, in the passage. These two contrasting situations are illustrated in (3) and (4).

(3) Mr. Kozek works for the city of Jamestown. He is busy the year around. In the early spring, he trims trees along the streets. This helps drivers to see better. He also cleans out drains so that rain water can run off. In late spring, summer, and fall he drives a street sweeper. The sweeper's brushes clean dirt off streets fast. Winter brings much snow. After a big storm, Mr. Kozek works day and night clearing streets. He sprinkles sand or salt on icy spots. His favorite job comes around Christmas time. Then he decorates the city's big Christmas tree. Mr. Kozek's work is never done.

20. What does Mr. Kozek do when he "trims" trees?

a) Decorates trees
b) Waters trees
c) Cuts off tree branches
d) Cuts down trees (I.T.B.S., p. 9)

(4) Do you know about a river that fights the ocean? One that does is the Amazon, one of the great rivers of the world. You may know that this river is in South America. It runs west to east, roughly along the equator, almost from the Pacific Ocean to the Atlantic, mostly through dense jungle. It is 3900 miles long and is fed by 1100 other rivers and streams, its tributaries. . .

66. A "tributary" is which of these?

a) A river that runs into the ocean
b) A stream that runs into another stream
c) A river that runs a great distance
4) An ocean that is fed by a river (I.T.B.S., p. 14)

In (3), a literal interpretation of <u>trim</u> would direct children toward (c), which is indeed the answer. But note the use of quotation marks around <u>trims</u>, setting up the inference that the idiomatic use of <u>trim</u>, as in "trim the Christmas tree" is being called forth. Option (a) then becomes not just a perfectly reasonable choice, but actually the most reasonable one.

Item no. 66 illustrates the opposite situation, where a masquerading or blocked inference is the answer. Consistently in the passage, the Amazon is referred to as a river, and, as can be seen in the last sentence of the exerpt in (4), rivers and streams are differentiated in the passage. Yet to answer the item correctly, children must collapse rivers and streams into one category, represented by streams to choose (b), "A stream that runs into another stream."

This last phenomenon, the answer being discouraged by information in the passage, does not happen often, but its counterpart, as might well be imagined, is the most frequent source of ambiguity in the test. All too often, distractors are perfectly reasonable inferences available from the passage.

A few other individual trickinesses are worthy of mention. First, a test question may repeat a key lexical item from a long passage, setting up the expectation that the answer lies near the lexical item in the passage, when in fact, it does not, as in (5).

(5) ¶ 1 A creature less than one-quarter inch at its largest has provided one of the mysteries of the world. This is the reef-building coral. The mystery, even to scientists, is how certain coral reefs came into being.

. . .

¶ 4 . . . The significant thing about both atolls and barrier reefs is that they rise steeply from the ocean floor, which may be 5,000 to 15,000 feet below the surface. It is this that presents the puzzle, since coral can live, grow, and leave its skeleton at depths not to exceed 200 feet.

159. Why is the coral reef a mystery to scientists?

a) Coral reefs may be found in water too cold for coral to live.
b) Coral reefs are found in only one part of the world.
c) Coral reefs may rise from water too deep for coral to live.
d) Coral reefs may be found where there is no live coral. (I.T.B.S., p. 24)

Repetition of the words mystery, in particular, and also scientists in the test question are likely to make children think the answer lies in the first paragraph, where these words occur in the passage. Instead, however, the answer, (c), is to be found in the last two sentences of the fourth paragraph, where the word puzzle must be understood as a synonym for mystery. The task of answering this item is made additionally complex because (d) is a perfectly reasonable inference based on information lying elsewhere in this long complex passage.

In a second type of trickiness, a test question may be inferentially inappropriate to a passage, as in (6).

(6) ¶ 6 . . . About an hour later, the curd, like leather now, was taken out, put through a food grinder, and salted. We came for our taste of the salted curd crumbs; but they were handed out sparingly because there must be enough left to make a good-sized cheese. They were packed into the cheesecloth in the hoop again, and the cheese was ready for the press.

¶ 7 Each cheese was taken out of the press every morning, trimmed of any think edges that had squeezed between the hoop and stoppers, wrapped in fresh cheesecloth, and put back in the press under still heavier weights. Our final treat was to eat the trimmings. When the cheese was pronounced "pressed," it was generously rubbed with butter to keep the rind soft, and sewn into a cheesecloth cover which we delightedly accepted as its "jacket,". . .

152. Why was the cheese pressed again a second time?

a) To squeeze out any liquid
b) To pack the curd crumbs tightly together
c) To make it soft and round
d) To get the "trimmings" out (I.T.B.S., p. 22)

The use of the adverb again and the indefinite article a wrongly sets up the inference that the cheese was pressed only two times. This opens up

purposes of each pressing after the first one as a possible answer. Thus while (b), the answer, is the specific purpose of the second pressing, (a), (c) and (d) are all purposes of the procedure, and therefore are reasonable options.

In a third type of trickiness, the answer may actually be a logical impossibility based on information in the passage, as in (7), which occurs following the passage in (3).

(7) 18. Why does Mr. Kozek sprinkle salt or sand?

a) To keep streets from getting slippery
b) To decorate the streets
c) To help clean the streets
d) To help drivers see better (I.T.B.S., p. 19)

The relevant sentence in the passage is "He sprinkles sand or salt on icy spots," and the answer is (a) "To keep streets from getting slippery." If streets are already icy, they cannot be kept from getting slippery; they already <u>are</u> slippery. The six third graders I interviewed did not notice this conflict, but it does not seem that success on a good test of reading comprehension should depend on children's failure to notice inconsistencies in the language of the test.

3.0 Within a month following administration of the test in Montgomery County Public Schools, I interviwed six children each in grades three, five, and seven, two at each level being judged by their teacher as low, average and high ability readers. This gave me a noticeable spread of reading ability and verbal skill. Although the sample is small, it provided me with a wealth of data about children's reasoning processes.

I interviewed each child individually, spending the first few minutes helping children to relax. I aimed to make the children feel that this was not a testing situation, that I was not concerned with correctness, but rather with their reasons for making choices, the means by which they eliminated answer options they did not choose. I then let them review or read a passage at their leisure, and we discussed a few items pertaining to it. The choice of passages and items was standard for each grade level. My interview was also standard: I first asked them which answer option they would choose or chose (if they remembered) on the test, then what made them choose it, and finally, if there were any other answer options they had difficulty eliminating. Our discussions often got quite long and involved. I do not know how the things children said during the interviews relate to the strategies they employed in actually taking the test. Several children mentioned that they saw many more ambiguities during the interview than they had in taking the test. This is not surprising given the distinction between a relatively relaxed interview situation and a rather strained timed test-taking situaiton.

To date, the tape recorded interviews of fifth and seventh graders discussing the four items pertaining to (8) below have been transcribed and analyzed. Only one child answered all the items incorrectly: a fifth grader judged to be of low reading ability. Only one child answered all the items correctly: a seventh grader judged to be of high reading ability. While this is probably not purely accidental, it by no means constitutes a generalization about reading ability and performance, in the setting of the interview, on the test. If there is any generalization to be made, it is that the test does not seem to discriminate against any group in my sample (if such can be said to exist). It discriminates against everyone.

(8) "Save your Christmas trees," read the poster. "Members of the Junior Nature Club will pick them up January 2."

"What do you do with old dry trees?" Mrs. Hawkins asked Bill Tompkins, when he came to get her tree. "They're surely not good for anything but a bonfire."

"Oh, no," answered Bill. "They're important conservation tools. We plan to take the trees we collect to the country. There we'll stack them up like tepees in gullies or windblows. The trees make fine homes for birds and small animals during the winter. Rabbits especially like them. By March, the trees will have settled down. Then they will keep the soil from washing or blowing away. We can do two things at once: help wildlife and prevent erosion."

"There's one more thing your club does," added Mrs. Hawkins.

"What's that?" asked Bill.

"You help clean up our town," she replied. "Thank you."

71. Why did Mrs. Hawkins thank Bill for getting her tree?

a) He was helping wild animals.
b) He was helping to stop soil from blowing or washing away.
c) He was helping her clean her house.
d) He was helping to make the city neat.

72. When would the trees be most useful in helping to stop erosion?

a) In summer
b) In winter
c) In spring
d) In fall

75. What would be the <u>main</u> purpose of placing trees in gullies?

a) To keep the dirt from washing away
b) To keep the dirt from blowing away
c) To provide homes for rabbits
d) To decorate bare spots in the country

78. Where was the club going to put the trees?

a) Near the farmhouses in the country
b) Near rabbit holes
c) In unprotected areas
d) Back in the forest (I.T.B.S., p. 15)

Item no. 71 is ambiguous with respect to the scope of Mrs. Hawkins' statement of thanks. It can be understood to pertain just to the preceding sentence, "'You help clean up our town,' she replied." It can also be understood to encompass the reasons for collecting the trees given in the third paragraph. The latter interpretation is possible because the occurrence of one more in Mrs. Hawkins' statement, "There's one more thing your club does," clearly implies her appreciation of the club's efforts toward conservation. The narrow interpretation of Mrs. Hawkins' expression of gratitude makes (d) the best answer, in spite of the fact that towns are different from cities (something which troubled one fifth grader who nevertheless did choose (d)). The broader interpretation opens up both (a) and (b) as reasonable answers. The answer is (d). This item is categorized in the teacher's guide (p. 33) as one which tests comprehension of details conveyed explicitly in the passage. This is interesting for two reasons. First, the information is not explicitly conveyed; it is implicitly available. Second, of the eight children who selected option (d), four treated the question as if the reason for Mrs. Hawkins' expression of gratitude was explicitly conveyed. For example, Kim, a fifth grader, said: "It said that she thanked Bill because he was helping to make the city neat." Of children who noted the ambiguity in the item, Connie, a seventh grader, was able to be most explicit about what constitutes a successful test-taking strategy:

> The trees were supposed to help the soil and wild animals, but they don't have soil and wild animals all in one question, and you have to come up with one answer so the last sentence she said was "He was helping to make the city neat." and that's what (d) says.

More children got this item right than they did the others pertaining to this passage. What is perhaps most significant about this is that it was easiest to get it right if they did not notice the ambiguity.

Item no. 72 is categorized in the teacher's guide (p. 33) as one which tests comprehension of information or details conveyed implicitly in the passage. However, the clues are not at all clear. The relevant part of the passage appears in the third paragraph: "By March the trees will have settled down. Then they will keep the soil from washing away." The answer options force us to conclude the trees are most useful during one season and only one. The phrase "by March" implies that the season starts at the beginning of March, which is not, of course, the beginning of a season. We are apparently supposed to infer that the season continues through March into some month that roughly marks the end of spring, and choose (c) for the answer. In my interviews I noticed a marked tendency, especially among the fifth graders, to turn to real world information about when the most rain or snow falls and when the wind blows most to choose an answer. I think the use of the word <u>would</u> in the question functions to encourage such speculation, setting up the inference that the answer does not lie in the passage. Fifth grade responses were distributed evenly over winter, spring and summer. The seventh graders favored spring more heavily with winter being a close runner up. The following effort by Jeff represents a sophisticated fifth grade response. Notice how he starts with background information and then proceeds to work his way through part of the passage to choose his answer.

> Well, it could be winter, and it could be most any time - just by knowing spring is the most time when snow melts - but like in winter the winds could blow the soil away if it wasn't snowing - and summer the rains and all could blow it away - and fall the wind and all - so . . . they all said - from the question up here (pointing to item no. 71) - he was helping to stop soil from blowing or washing away - and uh - he said right here we'll stack 'em up like teepees and uh the trees make find homes for birds and that so . . . By March the trees will have settled down - that was another thing - in spring is March . . . and they say "Then they will keep the soil from washing or blowing away" but even in March the wind doesn't blow that much - mostly if its in a gully - that's where water goes - in a gully - 'cause there's a ten-foot one in our backyard and the - umm - like the wind blows in summer and winter and spring snow melts, and wind blows in fall, and it rains in summer - so there's - if people didn't - like - it says "by March" but people could just forget that.

Jeff was the only fifth grader who made his decision based on the word March. Seventh graders tended to look more to the passage for clues, though not always successfully. Lisa, for example, noticed the mention of January at the beginning of the passage and opted first for winter.

The students I interviewed live in a part of the country where spring comes early. One seventh grader, Stan, noted that he didn't know what March weather was like in other parts of the country, but it did not seem to trouble him that the weather he was familiar with might be wrong for answering the question. I would be interested in knowing how children from Iowa fare on this item.

Using the passage to arrive at the answer to item no. 75 requires some rather sophisticated knowledge of discourse structure. It is the parallelism in structure of two sentences, separated by three sentences that contains the clue: The first, in the third paragraph, the fourth sentence, is "There

we'll stack them up like teepees in gullies or windblows"; the second, three sentences down, is "Then they will keep the soil from washing or blowing away." Using the ordering of the conjuncts in these two sentences, it is possible to make the inference that the main purpose of placing trees in gullies would be (a), "To keep the dirt from washing away." Elusive as this parallelism in sentence structure is, it is made the more so by virtue of the fact that windblows are not something that many people I know, and definitely not the fifth and seventh graders I talked to, have ever heard of. Windblow is not in my American Heritage Dictionary. I finally found it in Webster's Third; it is a deposit of windblown sand. The problem of conjoining a word like windblow with gully is that whereas a gully is naturally thought of in terms of its shape, a windblow is intuitively conceptualized as a place where something happens, namely the wind blows. My impression, although I would have a hard time verifying it, is that none of the children I talked to thought of a windblow as a noun; it remained a somewhat oddly used noun-verb sequence. Thus, the parallelism in sentence structure that contains the key to the answer went unnoticed by all the 12 children. Three fifth graders and two seventh graders did choose (a), however. Most of these children deliberated between (a) and (b) and finally concluded something to the effect that gullies are depressions in the ground, probably protected from the wind. A few children had had direct experience with gullies and immediately associated them with water.

Six children chose (c) for their answer. In an effort to understand why, I found that they got more or less entangled in what I call the especially trap. Notice the sentence, "Rabbits especially like them," in the third

paragraph. Children who got most entangled in the especially trap seemed to translate this sentence to something like "The trees are placed in gullies especially for rabbits." For example, Jason, a fifth grader said:

> It said in the story put 'em in the gullies and they use 'em for rabbits - for the rabbits especially and all the different animals to get in there without the wind or anything.

Other children who got slightly less entangled in the especially trap simply made the inference that if rabbits especially liked the tree teepees, then the main purpose of putting them in gullies would be to provide homes for rabbits. In my sample, likelihood of entanglement in the especially trap did not decrease with increased age or judged reading ability. Stan, a seventh grader judged as a high ability reader, could not choose between (a) and (b), then went back and chose (c) because "it says they especially like trees." Being testwise means being able to avoid the especially trap and knowing that when more animals than just rabbits are mentioned in the passage, answer options that mention only rabbits can't be right. As one fifth grader, Kim, told me, "They do provide homes for rabbits, but they're not just for rabbits."

Item no. 78 is categorized in the teacher's guide (p. 33) as one that tests comprehension of explicitly conveyed information. I was often surprised at items that were categorized this way, but this one was quite astounding. "In unprotected areas" is the answer. Presumably both gullies and windblows would only be located in unprotected areas. But if you've never heard of a windblow and, for example, you have a gully in your backyard, or know of one in a forest, (c) is not an obvious choice. Connie, a seventh grader, was most articulate about a successful strategy for answering the question. She chose

in unprotected areas "Well, because the farmhouses would have their own trees around them. Rabbit holes don't need the trees too much cuz they live under the ground. And the forest already has trees over it to protect the ground underneath."

Unlike the case with item no. 72, the fifth graders showed a tendency to want to rely on the passage for their answer, and three chose (a) because the passage mentioned the country, though each of the three was troubled by the lack of mention of farmhouses.

I am going to let Jeff, a fifth grader's confusion with this item, summarize my paper for me. After a long pause he said,

> They just said in the country - shelter - I'd guess near farmhouses in the country cuz they said in the country - but then they also mention rabbits and the unprotected areas would be the gullies and back in the forest would be - you know, because we have a gully in the forest and trees go right up the middle of it so - I don't know - I put (a) cuz they mention country in it but I just really took a good guess because there are so many right answers.

Footnotes

[1] In the I.T.B.S. test booklet, answer options for a question are identified by numbers. Because examples cited in this paper are identified by number, the numbers of the answer options have been changed to letters to avoid confusion.

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